In this paper, an artificial neural network (ANN) was used to predict the injury severity of traffic accidents based on 5973 traffic accident records occurred in Abu Dhabi over a 6-year period (from 2008 to 2013). For each accident record, 48 different attributes had been collected at the time of the accident. After data preprocessing, the data were reduced to 16 attributes and four injury severity classes. In this study, WEKA (Waikato Environment for Knowledge Analysis) data-mining software was used to build the ANN classifier. The traffic accident data were used to build two classifiers in two different ways. The whole data set were used for training and validating the first classifier (training set), while 90% of the data were used for training the second classifier and the remaining 10% were used for testing it (testing set). The experimental results revealed that the developed ANN classifiers can predict accident severity with reasonable accuracy. The overall model prediction performance for the training and testing data were 81.6% and 74.6%, respectively. To improve the prediction accuracy of the ANN classifier, traffic accident data were split into three clusters using a $k$-means algorithm. The results after clustering revealed significant improvement in the prediction accuracy of the ANN classifier, especially for the training dataset. In this work, and in order to validate the performance of the ANN model, an ordered probit model was also used as a comparative benchmark. The dependent variable (i.e. degree of injury) was transformed from ordinal to numerical (1, 2, 3, 4) for (minor, moderate, severe, death). The R tool was used to perform an ordered probit. For each accident, the ordered probit model showed how likely this accident would result in each class (minor, moderate, severe, death). The accuracy of 59.5% obtained from the ordered probit model was clearly less than the ANN accuracy value of 74.6%.